

What is Claimed is:

1           1. A method of monitoring a plurality of wireless transmitters within a monitored  
2 area, comprising:

- 3           (a) transmitting a signal from at least one of the plurality of wireless transmitters;  
4           (b) receiving the signal transmitted from said at least one of the plurality of wireless  
5 transmitters by at least one of a plurality of receiving devices;  
6           (c) scanning the received signal for a signal modulating code;  
7           (d) detecting the signal modulating code within the signal; and  
8           (e) determining a location of said at least one of the plurality of wireless transmitters  
9 based upon the signal modulating code detected and an identifier for the at least one of the  
10 plurality of receiving devices that received the signal;

11           wherein the signal modulating code includes a common code that identifies a group of  
12 wireless transmitters that includes said at least one of the plurality of wireless transmitters and a  
13 unique code that uniquely identifies said at least one of the plurality of wireless transmitters; and

14           wherein the common code of the signal modulating code is used to determine whether  
15 said at least one of the plurality of wireless transmitters is within an alert zone restricted to the  
16 group of wireless transmitters and the unique code of the signal modulating code is used to  
17 determine the location of said at least one of the plurality of wireless transmitters.

1           2. The method of claim 1, wherein the signal modulating code is a multiplexed  
2 combination of the common code and the unique code.

1           3. The method of claim 2, wherein in step (b) the receiving device is a signal relay  
2 and step (b) further includes:

- 3           (b1) relaying the received signal from the signal relay to a signal processing computer;  
4           and  
5           wherein in step (c) said scanning is performed by the signal processing computer.

1           4. The method of claim 3, wherein step (d) further includes:

2           (d1) upon detecting the signal modulating code, sending to a system controller a  
3           detection notification that includes said signal modulating code and an identifier of the signal  
4           relay that received the signal; and

5           wherein step (e) further includes:

6           (e1) determining, at the system controller, the location of the transmitter based upon  
7           information received in at least one detection notification.

1           5. The method of claim 1, wherein in step (c) the signal is scanned using match filtering  
2           techniques.

1           6. The method of claim 5, wherein the matched filtering techniques use a matched filter  
2           that is based upon the common code portion of the signal modulating code.

1           7. The method of claim 6, wherein step (e) further includes:

2           (e1) determining that said one of the plurality of wireless transmitters is within an alert  
3           zone based upon the matched filter identifying the common code portion of the signal modulating  
4           code in a signal received by a receiving device associated with an alert zone;

5           (e2) issuing an alarm upon determining that the detected common code is not authorized  
6           for the alert zone.

1           8. The method of claim 7, wherein step (d) further includes:

2           (d1) determining a signal strength of the received signal; and

3           wherein step (e) further includes:

4           (e3) refining the location of the transmitter based upon the signal strength of the received  
5           signal and a correlation of the signal strength with at least one pre-recorded signal strength value  
6           measured for a signal transmitted from a known location within the monitored area and received  
7           at the same receiving device as the received signal.

1           9. The method of claim 5, wherein the matched filter is based upon the signal modulating

2 code.

1 10. The method of claim 1, wherein in step (c) the signal is scanned using CDMA match  
2 filtering techniques.

1 11. The method of claim 1, wherein step (d) further includes:  
2 (d1) determining a signal strength of the received signal.

1 12. The method of claim 11, wherein in step (e) determining the location of the  
2 transmitter further includes:  
3 (e1) refining the location of the transmitter based upon the signal strength of the received  
4 signal and a correlation of the signal strength with at least one pre-recorded signal strength value  
5 measured for a signal transmitted from a known location within the monitored area and received  
6 at the same receiving device as the received signal.

1 13. The method of claim 1, wherein step (d) further includes:  
2 (d1) determining a signal strength of the signal detected using CDMA matched filter  
3 techniques.

1 14. A system for monitoring a plurality of wireless transmitters within a monitored  
2 area, the system comprising:  
3 a plurality of wireless transmitters, each configured to transmit a signal modulated  
4 with a signal modulating code;  
5 a signal relay that receives and relays a modulated signal from at least one of the  
6 plurality of wireless transmitters;  
7 a signal processing computer that receives at least one signal from the signal relay,  
8 scans for the signal modulating code within the signal and transmits a detection notification  
9 that includes information about the signal; and  
10 a system controller that receives detection notifications from the signal processing  
11 computer and determines a location of said at least one of the plurality of wireless

12 transmitters based upon information included within at least one detection notification;

13 wherein the signal modulating code includes a common code that identifies a group of  
14 wireless transmitters that includes said at least one of the plurality of wireless transmitters and a  
15 unique code that uniquely identifies said at least one of the plurality of wireless transmitters; and

16 wherein the common code of the signal modulating code is used to determine whether  
17 said at least one of the plurality of wireless transmitters is within an alert zone restricted to  
18 the group of wireless transmitters and the unique code of the signal modulating code is used  
19 to determine the location of said at least one of the plurality of wireless transmitters.

1 15. The apparatus of claim 14, wherein the signal relay is configured to receive a CDMA  
2 signal from at least one of the plurality of wireless transmitters.

1 16. The apparatus of claim 14, wherein at least one of the plurality of wireless  
2 transmitters is configured to send a signal modulating code that is a time multiplexed  
3 combination of the common code and the unique code.

1 17. The apparatus of claim 14, wherein the signal processing computer is configured to  
2 scan the relayed signal using CDMA matched filter techniques.

1 18. The apparatus of claim 14, wherein the signal processing computer is configured to  
2 generate a detection notification that includes the received signal modulating code and an  
3 identifier for the signal relay that received the signal.

1 19. The apparatus of claim 18, wherein, upon detecting a signal modulating code, the  
2 signal processing computer is configured to determine a signal strength of the received signal.

1 20. The apparatus of claim 19, wherein the signal processing computer is configured to  
2 generate a detection notification that further includes the signal strength of the received signal.

1 21. The apparatus of claim 20, wherein the system controller is configured to refine a

2 determined location by correlating signal strength information received in at least one detection  
3 notification with pre-recorded signal strength values measured for a signal transmitted from a  
4 known location within the monitored area and received at the same signal relay as the received  
5 signal.

1 22. The apparatus of claim 14, wherein the system controller is configured to determine  
2 whether said at least one of the plurality of wireless transmitters is in an alert area based upon the  
3 common code portion of the signal modulating code and the signal relay identifier received in at  
4 least one detection notification.

1 23. The apparatus of claim 14, wherein the system controller is configured to determine  
2 the location of said at least one of the plurality of wireless transmitters based upon the signal  
3 modulating code and the signal relay identifier received in at least one detection notification.

1 24. The apparatus of claim 14, wherein the system controller is configured to execute  
2 within the signal processing computer.

1 25. The apparatus of claim 14, wherein the signal relay is configured to relay the received  
2 signal to the signal processing computer via a cable based connection.

1 26. The apparatus of claim 14, wherein the signal relay is configured to relay the received  
2 signal to the signal processing computer via a wireless connection.

1 27. A wireless transmitter for use in a monitoring system that monitors a plurality of  
2 wireless transmitters within a monitored area, the wireless transmitter comprising:  
3 an information store that stores a common code assigned to the wireless transmitter;  
4 an information store that stores a unique code assigned to the wireless transmitter;  
5 a code generator that generates a signal modulating code based upon the stored  
6 common code and the stored unique code;  
7 a transmitter controller that controls transmission of a signal modulated with the

8 generated signal modulating code; and

9 an RF transmitter that broadcasts the signal to at least one monitoring system receiving  
10 device;

11 wherein the common code identifies a group of wireless transmitters that includes the  
12 wireless transmitter and the unique code uniquely identifies the wireless transmitter; and

13 wherein the monitoring system uses the common code portion of the signal modulating  
14 code to determine whether the wireless transmitter is within an alert zone restricted to the group  
15 of wireless transmitters and the monitoring system uses the unique code portion of the signal  
16 modulating code to determine a location of the wireless transmitter within the monitored area.  
17

1 28. The apparatus of claim 27, wherein the code generator is configured to generate a  
2 signal modulating code that is a time multiplexed combination of the common code and the  
3 unique code.

1 29. The apparatus of claim 27, wherein the RF transmitter is configured to transmit  
2 continuously.

1 30. The apparatus of claim 27, wherein the transmitter is configured to transmit  
2 periodically.

1 31. The apparatus of claim 27, wherein the transmitter is configured to transmit a CDMA  
2 signal.

1 32. A signal processing computer for use in a monitoring system that monitors a  
2 plurality of wireless transmitters, the signal processing computer comprising:

3 a channel communication interface that receives a signal, relayed via at least one  
4 signal receiving device, from at least one of the plurality of wireless transmitters;

5 an analog-to-digital converter that digitizes the relayed signal;

6 a signal detection module that scans the digitized signal for at least a portion of a  
7 signal modulating code;

8 a signal processing controller that coordinates said digitization and scanning and  
9 controls transmission of a detection notification to a system controller; and

10 a communication interface that transmits the detection notification to said system  
11 controller;

12 wherein the signal modulating code includes a common code that identifies a group of  
13 wireless transmitters that includes said at least one of the plurality of wireless transmitters and a  
14 unique code that uniquely identifies said at least one of the plurality of wireless transmitters; and

15 wherein the common code of the signal modulating code is used to determine whether  
16 said at least one of the plurality of wireless transmitters is within an alert zone restricted to the  
17 group of wireless transmitters and the unique code of the signal modulating code is used to  
18 determine the location of said at least one of the plurality of wireless transmitters.

1 33. The apparatus of claim 32, wherein the signal modulating code is a time multiplexed  
2 combination of the common code and the unique code.

1 34. The apparatus of claim 32, wherein the signal detection module is configured to scan  
2 the digitized signal using CDMA matched filter techniques.

1 35. The apparatus of claim 32, wherein upon detecting one of a common code and a  
2 unique code the signal detection module is configured to determine a signal strength of the  
3 received signal.

1 36. The apparatus of claim 32, wherein the signal processing controller is configured to  
2 generate a detection notification that includes an identifier for the signal receiving device that  
3 received the signal and at least one of a detected common code and a detected unique code.

1 37. The apparatus of claim 32, wherein the signal processing controller is configured to  
2 generate a detection notification that further includes the signal strength of the received signal.

1 38. A system controller for use in a monitoring system that monitors a plurality of

2 wireless transmitters, the system controller comprising:

3 an information store that associates a signal modulating code with each of the  
4 plurality of wireless transmitters;

5 a communication interface that receives a detection notification from a signal  
6 processing computer that includes an identifier for a signal relay, that received a signal from  
7 one of the plurality of wireless transmitters and relayed the signal to the signal processing  
8 computer, and a signal modulating code detected within the received signal by the signal  
9 processing computer;

10 a system controller module that stores information received in the detection  
11 notification and determines a location of said one of the plurality of wireless transmitters  
12 based upon information received via at least one detection notification; and

13 a user interface that exchanges information related to operation of the monitoring  
14 system with a user;

15 wherein the signal modulating code includes a common code that identifies a group of  
16 wireless transmitters that includes said one of the plurality of wireless transmitters and a unique  
17 code that uniquely identifies said one of the plurality of wireless transmitters; and

18 wherein the common code of the signal modulating code is used to determine whether  
19 said one of the plurality of wireless transmitters is within an alert zone restricted to the group  
20 of wireless transmitters and the unique code of the signal modulating code is used to  
21 determine the location of said one of the plurality of wireless transmitters.



1           39. The apparatus of claim 38, wherein the system controller module is configured to  
2 determine whether a transmitter is located in an alert area based upon the common code portion  
3 of the signal modulating code, the signal relay identifier received in at least one detection  
4 notification and associations stored within the information store.

1           40. The apparatus of claim 38, wherein the system controller module is configured to  
2 determine the location of said one of the plurality of transmitters based upon the signal  
3 modulating code and the signal relay identifier received in at least one detection notification.

1           41. The apparatus of claim 38, wherein the communication interface is configured to  
2 receive a detection notification that further includes a signal strength of the received signal.

1           42. The apparatus of claim 41, further comprising:  
2 a power signature information base that includes pre-recorded signal strength values  
3 measured for a signal transmitted from a known location within the monitored area and received  
4 at an identified signal relay.

1           43. The apparatus of claim 42 wherein the system controller module is configured to  
2 refine a determined location by correlating signal strength information received in at least one  
3 detection notification with pre-recorded signal strength values associated with signals received at  
4 the same signal relay as the received signal.

1           44. The apparatus of claim 38, wherein the system controller module is configured to  
2 execute within the signal processing computer.